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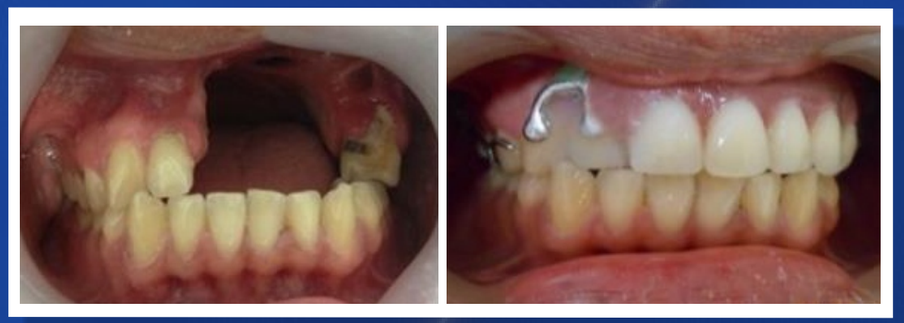

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Prosthetic rehabilitation with framework obturator for hemimaxillectomy patient – A case report

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ABSTRACT
Postoperative hemimaxillectomy defects cause the patient to develop conditions such as nasal discharge (hypernasal speech), leakage of fluid in the nasal cavity, and deterioration of masticatory function. Thus, comprehensive rehabilitation is required to improve mastication, speech function and normal orofacial appearance. Successful prosthetic rehabilitation of postoperative hemimaxillectomy defect is a challenging procedure that requires multidisciplinary expertise to achieve acceptable esthetics, functional speech and swallowing outcomes. This case report describes clinical steps and laboratory procedures involved in prosthetic rehabilitation of an Aramany Class IV hemimaxillectomy patient with framework obturator.
Keywords: postoperative hemimaxillectomy defects, prosthetic rehabilitation, framework obturator

INTRODUCTION

The defects in maxilla may be divided into defects resulting from congenital malformation and acquired defect resulting from surgery for oral neoplasm.[1,2] The defect could form an opening in the palate or roof of the mouth, where the size and location will affect the degree of repair and difficulty in prosthetic rehabilitation. Abnormalities in the maxilla causing the patient to experience nasal discharge (hypernasal speech), leakage of fluid in the nasal cavity, and deterioration of the masticatory function.[1,2]

The prosthesis required to repair this defect is an obturator. Obturator which in *Latin* is obturare, is an artificial disc or plate used to close congenital gaps or defects or as a result of surgery, caused by cleft palate, partial or total maxillary resection due to malignant or benign tumors.[3]

Obturator has many functions. It can function as a Levin tube for breastfeeding, to keep the defect area clean, and improve defect healing, preventing muscle contraction in the area around the defect.[3] Lack of support, retention and stabilization are the most common problems in prosthetic rehabilitation for hemimaxillectomy patients.[3]

Successful prosthetic rehabilitation of hemimaxillectomy defect is quite challenging. The goals of prosthetic rehabilitation for partial or total maxillectomy patients include separation of the oral cavity and nasal cavity to achieve good masticatory, deglutation and articulation function, provide orbital support to prevent enophthalamos and diplopia, and support soft tissues to achieve a proportional middle facial contour, and aesthetic function.[3]

Prosthetic treatment for patients with postoperative maxillary defects can be divided into three phases of treatment, where each phase has a different objective.

Surgical obturator, a plate type appliance which is constructed from a pre-surgical impression cast and is inserted at the time of surgery (resection) in the operating room. The functions of a surgical obturator include reducing contamination of wounds in the mouth during the postoperative period, helping patient to speak more effectively by producing normal palatal contours and covering the defect, maintaining lips and cheeks contour so that patient will have closely normal appearance and improving the deglutation function so that the nasogastric tube can be removed earlier.[3]

Interim obturator, a constructed prosthesis from postoperative impression cast which has artificial palate and ridge but no teeth and used from 5-10 days after surgery to approximately 3-6 months, depending on the size of the defect and wound healing.[3] The closed bulb extending into the defect area is hollow. Because of the rapid soft tissue changes that occur within the defect during the organization and healing of the wound, the new lining material is placed or changed every two weeks. It is best to remove the entire old interim lining material because of porosity, leading to bacterial contamination and precipitation of undesirable odors and mucosal irritations. The periodic addition of interim lining material increases the bulk and weight of the obturator and this temporary material may become rough and unhygienic.[3]

Definitive obturator, can be constructed approximately 3-6 months after surgery or after the surgical wound has healed.[3] This condition is influenced by the size of the defect, the prognosis and progress of healing of the tumor, the condition of the

remaining teeth. The prognosis of an obturator depends on the size and shape of the jaw remaining after, condition of the soft tissue and the defect, alveolar ridge and remaining teeth. The problem frequently faced in the fabricating of obturator was the lack of retention and stabilization. These problems emerged as the result of traumatic functional occlusion and the inability to obtain a good oroantral or oronasal seal. However, when there are remaining teeth, the success of the treatments is more predictable.

The basic principles of making obturator are the maximum benefit, function, and comfort of the prosthesis.[4] The general principles of a partial denture design are also applied to construct the obturator, such as the need for a rigid major connector, guide planes and other components that support stabilization, design for maximum support, rest that is placed along the axis of the supporting tooth, passive multiple direct retainers that are used to provide sufficient resistance to prevent obturator movement without harming the abutment teeth, as well as control the occlusal plane opposite of the defect, especially when involving natural teeth.[4] The abutment tooth determination is determined based on the location of the defect as well as the position of the tooth in the remaining jaw, crown condition, and periodontal support. The remaining teeth that are not in ideal condition are supported by splinting them with the healthy teeth. Apart from the size and location of the defect, the number and position of the remaining teeth, one thing that is essential in making definitive obturator is how to distribute support from the obturator as widely as possible. This is achieved by involving multiple teeth into the framework design and maximizing the use of the singulum and occlusal rest, and the vertical guide plane to distribute the functional load. Maximum extension to the remaining palate, alveolar ridge, and load-bearing area around the defect will increase support of the prosthesis.[4]

The Aramany classification system for post-surgical maxillectomy defects is used to design a metal frame obturator.[5-7] The Aramany classification is divided into 6 groups; **Class I**, that is the resection is performed in the anterior midline of the maxilla, with abutment teeth present on one side of the arch. **Class II**, the defect in this group is unilateral, retaining the anterior teeth on the contralateral side. **Class III**, the palatal defect occurs in the central portion of the hard palate and may involve part of the soft palate. **Class IV**, the defect crosses the midline and involves both sides of the maxilla, with abutment teeth present on one side. **Class V**, the surgical defect is bilateral and lies posterior to the abutment teeth. Labial stabilization may be needed. **Class VI**, anterior maxillary defect anterior with abutment teeth with abutment teeth present bilaterally in the posterior segment.

Figure 1 Aramany classification system for maxillectomy defects (Source: Durrani Z, Hussain SG, Alam SA. A study of classification systems for maxillectomy defects. J Pakistan Prosthodont Assoc 2013; 1(2): 117-24)

Supporting teeth and periodontal tissue must be in good condition and restored before starting the prosthetic rehabilitation. The principle of design according to Aramany classification are class I tripodal design and linear design, class II tripodal design, class III quadriteral design, class IV linear design, class V tripodal design, and class VI quadriteral design. Quadrilateral and tripodal designs have more benefits over linear designs because they have better support, stability and retention of the prosthesis.[4,5]

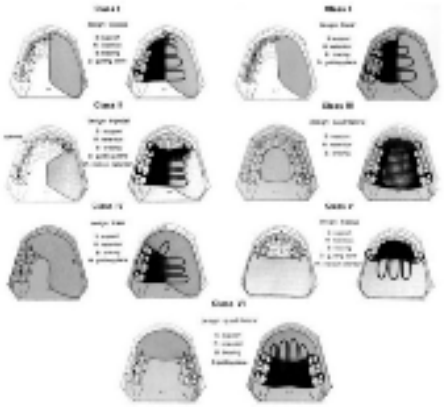

Figure 2 Principle of framework obturator design according to Aramany classification. (Source: Parr GR, Tharp GE, Rahn AO. Prosthodontic principles in the framework design of maxillary obturator prostheses. J Prosthet Dent 2005; 93: 405-11).

This study discusses the fabricating of a definitive obturator for a hemimaxillectomy patient using a metal framework obturator.

CASE

A 35-year-old male patient came to Prosthodontic Department of RSKGM FKG UI to replace his old obturator since it is leaking everytime he eats and drinks. The patient underwent a hemi-

maxillectomy on 2008 and has been using the obturator for 4 years. It was made from acrylic with clasp wire.

Extraoral examination showed oval and asymmetrical face, straight profile, pupils were equal, tragus was the same height, nose was symmetrical and breathing through the nose was smooth, hypotonus lips, thin, asymmetrical, long temporomandibular joint (TMJ). (Fig.3A)

Evaluation of the old obturator, found that obturator condition was not ideal, retention and stabilization was lacking, broken clasp on tooth 16, so the obturator was wobbly or unstable when used. There was a cavity between the obturator edge and the scar band area so that there was a leak into the nasal cavity when the patient eats or drinks, esthetic was also not good. (Fig.3B)

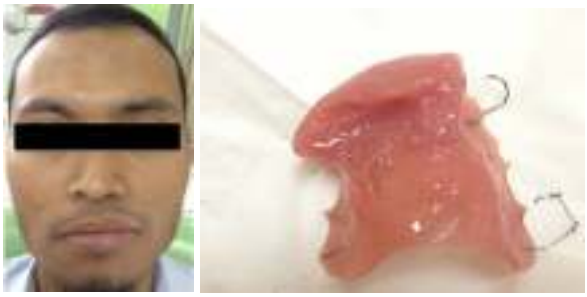

Figure 3A Extraoral view of the patient; **B** patient's old obturator made from acrylic with clasp wire.

Intraoral examination showed quite good oral hygiene, dental plaque and calculus slightly found, post-surgical hemimaxillectomy from regions 11 to 25, missing teeth 11, 21, 22, 23, 24, 25 unstable occlussion, posterior overbite 2 mm, posterior overjet 2 mm, and orthognathi maxillomandible relationship. Group function articulation is on the right side. There are 4 defects with a diameter of ± 5-10 mm in the hard palate that connect intraoral to the nasal cavity. The resection area is free of inflammation and covered with soft tissue. (Fig.4)

Figure 4 Intraoral condition of the patient

Radiographic interpretation showed no presence of maxilla bone and alveolar ridge bone from 11 to 25, crown-root ratio 2:3 in most remaining teeth except for teeth 12 and 26 1:2. (Fig. 5)

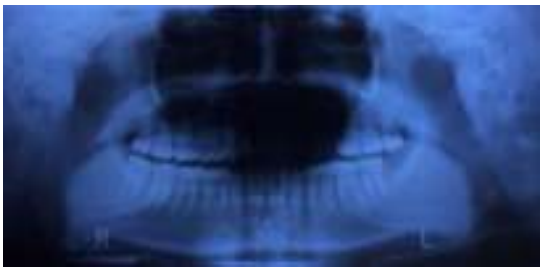

Figure 5 Panoramic radiograph of the patient.

From the data collected it can be concluded that this is a case of maxillary bone loss after hemimaxillectomy class VI Aramany requiring rehabilitation with a definitive maxillary framework obturator, the design could be seen in figure 6.

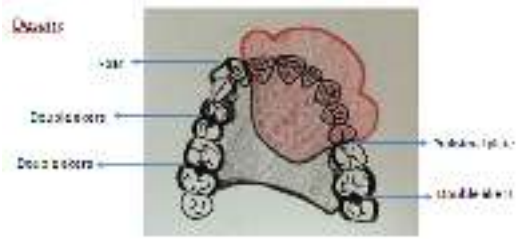

Figure 6 Design of the definitive framework obturator

MANAGEMENT

The initial treatment was done by removing dental calculus; followed by primary impressions procedure for maxillary and mandible using hydrocolloid impression material (*GC Aroma fine plus normal setting*). Study model was fabricated. Next appointment, preparation of double akers occlusal rest in 14 and 15, 16 and 17, 27 and 28, proximal plate at mesial 12 and mesial 26, palatal plate in 12 and 13 was done. Then, working model impression was taken using hydrocolloid impression material (*GC Aroma fine plus normal setting*). On laboratory step, working model casts were fabricated and metal framework was manufactured.

On the following visit, the metal framework was tried in patient's mouth and checked if the metal frame seated perfectly. Wax occlusal rim made from Cavex modelling wax was made on the framework and the jaw relations were recorded (Fig.7).

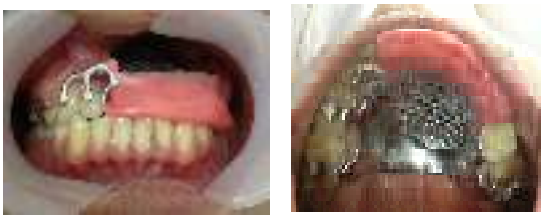

Figure 7 Metal framework intraorally and jaw relations record

Teeth arrangement was delivered on laboratory and then, tried-in procedure was carried out on patient (Fig.8).

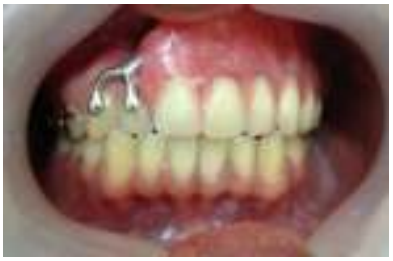

Figure 8 Wax try in procedure

Final prosthesis was fabricated in laboratory with heat cured resin. Polished final framework obturator was inserted to patient on next visit (Fig. 9). At this stage patient could swallow properly, but there was a leakage when rinsing his mouth and water came out of the nasal cavity.

Figure 9 Insertion procedure

To overcome this problem, reline procedure was carried out using green stick compound to mold the mucobuccal fold and a *GC soft liner denture relining material* (Fig.10).

Figure 10 Reline procedure with GC soft liner denture relining material

Occlusion and articulation were checked with articulating paper where contact on the anterior and posterior teeth was slightly light and the anterior teeth were free at articulation movement.

On the next visit, patient felt pain in the upper left posterior vestibulum area. On clinical examination using pressure indicating paste (PIP) there was a denture flange that was too long in the right posterior region and there was redness in that area. In that part, shortening and polishing the flange was done. The patient had used the obturator when eating, drinking, and speaking and had no complaints other than discharge from the nasal cavity. The intaglio area was reduced and ensured that there were no sharp edges. However, there was still a leakage when rinsing his mouth where water entered the left labial flange and came out from the nasal cavity. The reline procedure was done again, patient was asked to do functional movement such as smiling, sucking, smiling. On laboratory, the framework obturator was processed.

On the next visit, the framework obturator was inserted again (Fig.11). Mucosal adaptation was checked using PIP. No leakage was found during the insertion procedure. Control I was carried one day after insertion. Control II was performed three days after control I. Control III was 7 days after control II. There was no complaint from the patients, and no redness of the mucosa under the denture. Aesthetic, occlusion, retention, and stability of the framework obturator were good. Patient was instructed to maintain his oral hygiene and periodically came to the dentist for check up.

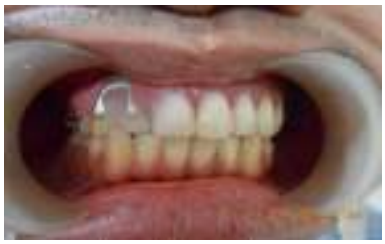

Figure 11 Final insertion of the framework obturator

DISCUSSION

Maxillary defect in this case belonged to class VI Aramany quadrilateral design in which the anterior teeth were used for obturator retention and support.[8] In this patient, the defect occurred due to trauma which resulted in the surgery of the hemimaxilla causing bilateral defects.

Support from the remaining teeth was still sufficient, and these teeth could still become supporting teeth. Obturator retention was obtained by maximizing the retention of the remaining teeth and also the retention of the defect itself so that the best possible dental condition was maintained.[9] Support was obtained from the rest located in the disto-occlusal most anterior supporting 12, 13 and double akers on 14, 15 and 16, 17. The greatest stability was achieved by placing the rest on the most posterior 16, 17 and 28. The guiding plane was placed on the proximal surface adjacent to the defect, 12 and 26, and also the palatal plate in contact with the palatal surface at a minimum height (1-2 mm) to prevent trauma to the abutment teeth during the movement of the prosthesis. Retention of this defect was obtained using the I bar retainer in the labial undercut of 12 and 13, reverse akers on 28, and double akers on 14, 15 and 16, 17 which were close to the fulcrum line. Additional retention was also achieved by extending the

prosthesis flange anteriorly to involve the nasal space. The use of a rigid major connector was also useful for evenly distributing functional forces to all parts of the metal framework obturator.[4,10] With this extension, aesthetic support of the nose and upper lip will also be achieved.

Retainer selection for removable prosthesis mainly depends on the remaining tooth structure, the intra and intermaxillary relationships, aesthetics and financial aspects.[4]

Stabilization is the resistance of the prosthesis to movement caused by functional stress.[4,11] Movements of the prosthesis could be in the horizontal plane include anteroposterior, mediolateral, rotational, or a combination of the above forces. The bracing component of the metal framework, maximum extension to the mucobuccal fold, and especially the extension of the labial flange are very important in minimizing movement in the horizontal plane.[4,11] Slightly thin and even contact during occlusion and articulation plays a very important role in stabilization.

In this case, the patient had used an obturator after a hemimaxillectomy so that it was easy for the patient to adapt and spoke more effectively by producing normal palatal contours that covered the defect, improved deglutation function. The aesthetic function could be obtained since there was no contraction of the labial muscles so that the patient's appearance looks good.

During insertion, the problem faced was water leakage when rinsing through the nose (nasal reflux). This problem is often encountered post-insertion, even several years after insertion this problem could occur because of the presence of fibrotic tissue on the edge of the obturator.[12] To correct this problem, a tissue conditioning material was used and the patient was instructed to perform functional movements. In this patient, a tissue conditioning material was applied, and the patient was asked to wear the obturator throughout the day including meals in order to obtain a functional mold of the prosthesis. On the next visit, processing obturator was carried out after using tissue conditioner and the edge leakage was resolved. Dimensional changes in tissue continue to occur for at least a year secondary to scar contracture and further organization of the wound.[2,11] The prosthesis is rebased to compensate for these changes. Changes in the tissues supporting a maxillofacial prosthesis maybe more rapid than in those supporting a more conventional prosthesis. Therefore, the occlusion and base adaptation must be re-evaluated frequently and corrected by selective grinding of the occlusion or rebasing of the prosthesis. Though it is difficult to improve the quality of life for hemimaxillectomy patients compared with conventional prostheses patients, this can be achieved with the help of skill, knowledge, and experience of specialists. The problem experienced by hemimaxillectomy patients are reduced if a team approach is adopted and specialists are careful to apply skill and experience at all stages and keep the patient under regular review.

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Effect of sisal fiber (*Agave sisalana*) and surface treatment on transverse strength in acrylic resin denture base repair

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ABSTRACT
Acrylic resin as a denture base material has a disadvantage; it is easily fractured. However, fractures can be repaired. This study aimed to reveal the effects of sisal fiber (*Agave sisalana*) and surface treatment on the transverse strength in acrylic resin denture base repair. A laboratory experiment was conducted on 30 acrylic resin samples with a size of 65 x 10 x 2.5 mm, consisting of group I (was on the repaired section), group II (sisal were to the repaired section) and group III (repaired were sisal fibers and applied with monomer). Transverse strength was measured using a universal testing machine. The data obtained were analyzed using 1-way ANOVA. The results showed that the lowest transverse strength was found in group I (88.30 ± 7.38 MPa) and the highest strength was in group III (133.45 ± 8.38 MPa). Based on the results of this study, it can be concluded that the use of sisal fiber and surface treatment can increase the transverse strength in acrylic resin denture base repair.
Keywords: acrylic resin, sisal fiber, surface treatment, monomer, transverse strength

INTRODUCTION

Tooth loss, which is a problem in oral cavity, can cause alveolar bone resorption and migration of adjacent teeth, as well as affect supporting tissues, the roles of masticatory muscles, health of the oral cavity, and a person's confidence. To prevent these things, a rehabilitation treatment with denture is needed.[1] One of the most commonly used dentures is partial removable denture. In its use as a denture base material, acrylic resin also has a disadvantage; it is easily fractured. This disadvantage often causes problems such as fracture of denture base due to compressive forces in the oral cavity and due to fall.[2]

Fracture of acrylic resin denture base can be repaired. The material used for the repair should be able to provide good strength, good color, good dimensional stability, affordable prices, easy, and fast application. The repair of acrylic resin denture base can be done by applying new acrylic resin on the fractured section.[3] Several efforts have been made to improve the transverse strength in the repair of acrylic resin denture base by adding fiber as reinforcing materials to the acrylic resin repair. The addition of fiber may produce good transverse strength, good adhesive bonds between fiber and acrylic resin, good aesthetic quality, and ease of application of fiber in acrylic resin.[4] Some natural fibers that are widely used to reinforce dental materials are hemp, kenaf, sisal, and abaca.[5]

One type of natural fibers that can be developed is sisal fiber (*Agave sisalana*) which has the mechanical properties as reinforcement of matrix.[6,7] Sisal fiber can be used to reinforce acrylic resin denture base because it is easy to apply, affordable, and has good mechanical properties as a reinforced polymer material.[7,8]

Success in improving the transverse strength in the repair of acrylic resin denture base, in addition to relying on fiber addition, also depends on the adhesion. Surface treatment is a treatment that can be performed to produce good adhesion. The surface to be repaired will be treated with particular chemicals, such as ethyl acetate, chloroform, acrylic resin monomers. In fact, treatment with acrylic resin monomers can cause gap and pit formation due to resin dissolution, which then produces strong adhesion.[9] This study aimed to examine the effect of sisal fiber (*Agave sisalana*) and surface treatment on transverse strength in acrylic resin denture base repair.

METHODS

This research on the effect of sisal fiber and surface treatment using monomers on the transverse strength in the repairs of acrylic resin denture base was conducted by laboratory experiment. The research samples were acrylic resin blocks with a size of 65 x 10 x 2.5 mm, consisting of group I (monomer was applied to the repaired section), group II (sisal fiber was given to the repaired section, and group III (the repaired section was given sisal fiber and applied with monomer).

The instruments used in this research were tool for making heat-polymerized acrylic resin samples, cold-cured acrylic resin stirrer, burs for pre-

paration, and universal testing machine for transverse strength testing. The materials used in this research were heat-cured acrylic resin to make the samples, cold-cured acrylic resin for repair materials, heat-cured acrylic resin processing materials, sisal fibers with a size of 30 x 5 mm, 6% NaOH for the alkalization of sisal fiber, and heat-polymerized acrylic resin monomers. This research was conducted by making research samples, preparing the research samples, making sisal fibers, repairing the research samples, and testing the transverse strength. The data obtained from the results of the transverse strength testing were collected and tabulated according to the treatment groups, followed by a statistical analysis using 1-way Anova.

RESULTS

Based on the results of this study, the lowest mean transverse strength on denture base repair was found on the group where monomer was applied to the repaired section (88.30 ± 7.38 MPa) and the highest (133.45 ± 8.38 MPa) was found in the group where the repaired section was applied with monomers and given sisal fibers (Table 1).

The 1-way Anova test showed a significant difference ($p<0.05$) in the transverse strength among group I, II, and III (Table 2). Based on these results, it can be concluded that there is an effect of addition of sisal fiber and application of surface treatment using monomers on the transverse strength in acrylic resin denture base repair.

LSD analysis was used to determine which groups gave significant differences in the transverse strength among the three groups (Table 3). The results of LSD analysis for all these groups showed that there was a significant difference in the transverse strength among all the treatment groups ($p<0.05$).

Table 1 Mean and standard deviation of transverse strength (MPa) in acrylic resin denture base repair

Group	Mean±Standard Deviation
Group I	88.30 ± 7.38
Group II	113.65 ± 7.31
Group III	133.45 ± 8.38

Group I: Repaired section applied with monomer
Group II: Repaired section given sisal fiber
Group III: Repaired section applied with monomer and given sisal fiber

DISCUSSION

The results of the study on the effect of sisal fiber and surface treatment using monomers on the transverse strength in acrylic resin denture base repair showed that the highest mean was found in the group repaired with monomer application and sisal fiber addition. The application of surface treatment by wetting the surface of acrylic resin denture base with chemical substances in the form of acrylic resin monomers can produce stronger adhesive bonds.[9] The fractured denture base surface will come in contact with acrylic resin monomers, dissolve, form gaps and pits, and produce mechanical interlocking bonds.[8,10] The application of surface treatment using monomers in the repaired section of acrylic resin denture base can produce strong adhesive bonds.[10] The penetration of repair materials to the base which undergoes erosion because acrylic resin denture base monomers dissolve will create bonds between polymer chains, thus improving the mechanical strength.[11]

Addition of fiber on acrylic resin denture base can improve the mechanical strength of the acrylic resin because the force received by the plate surface will be evenly distributed on the acrylic resin

Table 2 Results of 1-way ANOVA test on transverse strength in acrylic resin denture base repair

	Sums of Square	Degree of freedom	Mean Squares	F	Sig.
Among groups	7883.37	2	3941.68	66.343	0.000
Within group	1604.17	27	59.414		
Total	9487.54	29			

Table 3 LSD test on transverse strength in acrylic resin denture base repair

Group	Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence interval	
					Lower Bound	Upper Bound
Group I	Group III	-39.14400*	3.44714	0.000	-46.2169	-32.0711
	Group II	-25.34400*	3.44714	0.000	-32.4169	-18.2711
Group II	Group III	-13.80000*	3.44714	0.000	-20.8729	-6.7271
	Group I	25.34400*	3.44714	0.000	18.2711	32.4169
Group III	Group II	13.80000*	3.44714	0.000	6.7271	20.8729
	Group I	39.14400*	3.44714	0.000	32.0711	46.2169

plate, so fiber could absorb greater energy compared to acrylic resin plate without fiber addition.[11,12] Natural fibers, in the form of sisal fibers, have a good mechanical property as a reinforcing material of matrix.[7,8] The lowest mean transverse strength was found in the group where the repaired section was only applied with acrylic resin monomers as surface treatment. In fact, although acrylic resin denture repair material could penetrate into the repaired section, its transverse strength is 40-60% lower than the strength before fracture occurs. In the polymerization process of acrylic resin denture repair, not all monomers can be converted into polymers, so the remaining monomers can affect the mechanical properties of the acrylic resin denture repair.[13]

There were significant differences in the group only applied with monomers, the group only given sisal fiber, and the group applied with monomers and given sisal fiber. In the group where the repaired section was only applied with acrylic resin monomer, gaps and pits were formed, then the repair materials could penetrate into the acrylic resin, creating mechanical interlocking and adhesive bonds with minimum effects.[11,14] Addition of sisal fiber can improve the transverse strength of the repaired sections because sisal fiber can get embedded in resin.[15]

Based on the results of this study, it can be concluded that the addition of sisal fiber (*Agave sisalana*) and application of surface treatment using monomers can improve the transverse strength in acrylic resin denture base repair.

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Community service for infants with cleft lip and palate at *Mitra Sejati* and *Grandmed Hospital* North Sumatera

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ABSTRACT
Cases of cleft lip and palate (CLP) in infants were many in Medan and surrounding areas. There were about 150 cases of infants with CLP in a year handled by Mitra Sejati Medan Hospital and Grandmed Hospital Lubuk Pakan, but the treatment given was only surgical treatment, while the follow-up care, which is the fabrication of artificial palate or feeding plate before or after surgery, cannot be facilitated. Until now CLP further treatment cannot be done because the parents do not know the treatment and most of them came from groups with low socio-economic level and the fabrication of feeding plate required high costs. To overcome this problem, we held community service by fabricating feeding plates as feeding aids for babies with CLP. The method used to achieve this goal of service is collecting data from patients with CLP in the two hospitals, general examination by pediatrician, making the impression of the oral cavity to create the working cast, making outline design, doing the wax pattern and feeding plate fabrication in the laboratory using hard and soft acrylic materials combination. The insertion of feeding plates is performed at the hospital and evaluated whether the baby can drink milk normally using a bottle. Body weight changes are evaluated every month until the baby is declared ready for surgery.
Keywords: cleft lip, cleft palate, feeding plate

INTRODUCTION

Babies born with of cleft lip and palate (CLP) are unable to suckle normally.[1,2] The cleft of the palate due to imperfect unification at the time of fetal formation can cause the baby to choke because the water/milk can be potentially enter the respiratory tract. Babies with CLP usually drink through a hose or spoon, causing the nutritional intake is not maximal so the baby's weight is difficult to increase and general health decreases. Delayed treatment of CLP can reduce the confidence of the patients and their families due to aesthetic, function and speech disturbance. Therefore, a feeding aid appliance called feeding plate is recommended.[1,3]

Feeding plate is an artificial palate to help babies drink normally. Most CLP babies are unable to reach their normal weight due to insufficient intake.[1,4,5] Surgery for CLP babies must meet *the rule of 10* i.e. age 10 weeks, Hb 10, weight 10 pounds.[3,4,6] At this time the role of prosthodontist is very important especially in the manufacture of feeding plates so that babies can eat and drink normally so as to increase the baby's weight and general health of the babies. Once the rule of ten is met, the surgery can be done on time. The lack of information and financial capabilities of the community led to many CLP babies being comprehensively untreated. Therefore, a community service was carried out a community service in order to improve the quality of life of babies with CLP.

The community service team was led by a prosthodontist, with members consist of a prosthodontist and an oral surgeon, and was assisted by students of Prosthodontic Postgraduate Program, Faculty of Dentistry, Universitas Sumatera Utara. This community service is a Program of Non PNBP USU Resources under the Institute of Community Service, Universitas Sumatera Utara (LPPM USU). *Mitra Sejati Hospital Medan* and *Grand Med Hospital Lubuk Pakam* were chosen as partners in this community service, based on the idea that the high numbers of CLP cases were referred to both hospitals, due to the existence of oral surgeon in handling the cases surgically. *Mitra Sejati* and *Grandmed* are two hospitals in North Sumatra that have handled many cases of CLP (about 150 cases per year). However, the treatment given so far was limited to surgical treatment only. In fact, the treatment of CLP should be done comprehensively by pediatricians, oral surgeon and prosthodontists.

This article is intended to expose about community service for infants with CLP at *Mitra Sejati* and *Grandmed Hospital* North Sumatera

METHODS

Community service was conducted in 2 hospitals, namely *Mitra Sejati Hospital* Medan (Partner 1) and *Grandmed Hospital* Lubuk Pakam (Partner 2). The first stage was socialization with hospitals by providing education and information on the impor-

tance of making feeding plates in aspects of public health, oral and psychological health of patients as well as cooperation from hospital staff in handling infants and educating their parents (Fig.1).

Figure 1A Socialization at *Grandmed Hospital* Lubuk Pakam; **B** Socialization at *Mitra Sejati Hospital* Medan

The second stage, data collection and screening of infants with CLP in both hospitals, is conducted by oral surgeon, pediatrician, prosthodontists and students of Prosthodontics Postgraduate Program (PPDGS Prostodonsia FKG USU). The examinations included general health, blood test, baby weight and intraoral examination (Fig.2).

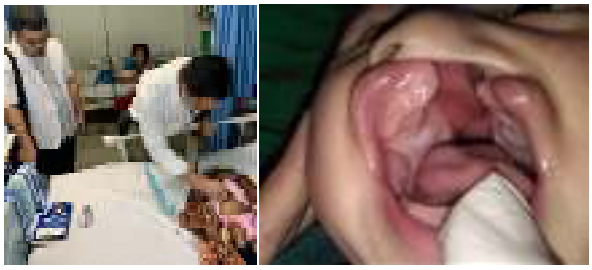

Figure 2A Patient examination; **B** baby with CLP

The third stage was performing maxilla impression by prosthodontists and students. The impression process was carried out in a surgical room under sterile conditions (Fig.3A). The first was 1) the baby was fasting 2-3 hours before the impression to prevent vomiting at the time of impression, then 2) breathing apparatus in the form of oxygen and suction were prepared with the assistance of an anesthesiologist, 3) impression trays in various sizes were prepared and sterilized, 4) soaking the printed spoon on the physiological solution before and after it was removed from the oral cavity. The impression trays were tried out to decide whether the tray is suitable with the baby's oral cavity. Furthermore, 6) the impression was taken with polyvinyl siloxane putty material (I-sil Regular Set Putty, Korean Spident) (Fig.3B), 7) after the material set, the impression was removed from the oral cavity. Afterwards, 8) examination of the baby's oral cavity to ensure there were no impression materials left, and 9) impression was evaluated.

Figure 3A Impression was carried out in a surgical room under sterile conditions, **B** impression with putty polyvinylsiloxan material and special tray for the babies.

The fourth stage, after impression was taken, the impression was evaluated whether a gap defect and limiting structure have been obtained to support the fabrication of feeding plates (Fig.4). After the evaluation, the impression was washed, the working casts was manufactured by using dental stone type IV, the outline form was designed and waxed up according to the different patient conditions (Fig.5).

The fifth stage, feeding plate manufacturing procedure in the laboratory, which includes 1) cast with wax pattern were inserted into the cuvette, then the cuvette was soaked in water; heated until the wax melted about 30 minutes, 2) the mold was packed with soft acrylic mixture for the inta-

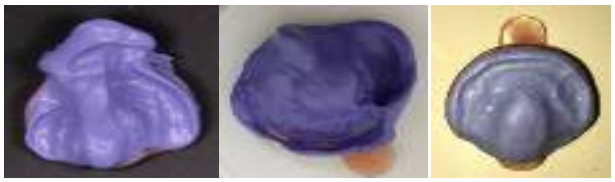

Figure 4 Imprints covering all defects and barrier structures

Figure 5 The waxed up according to the variations of the cleft.

Figure 6 The feeding plates after finished and polished

glio surface and hard acrylic mixture for the cameo surface 3) the cuvette was put in the water bath, heated it to reach 70ºC for 30 minutes, then continue heating until it reaches a temperature of 100ºC for 90 minutes, 4) after the polymerization was reached, the feeding plate was removed from the mold, 5) the feeding plate was finished and polished, and 6) the feeding plate was evaluated before insertion (Fig.6).

The sixth stage, the trial feeding plate and vestibule parts were conducted to prevent the movement of feeding plate when the wing of feeding plate was on a moving mucosa, and retention and stabilization were evaluated (Fig.7). After good retention and stabilization, mother was instructed to give milk to the baby using a bottle to see the feeding plate adaptation to the supporting tissue (Fig.8). After the baby can suck well, parents were taught to open, install and clean the feeding *plate* periodically.

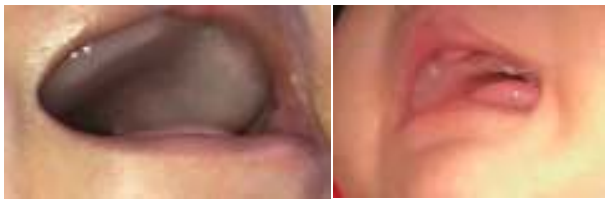

Figure 7 Feeding plate insertion

Figure 8 The babies were evaluated for suction and swallowing ability with feeding plate used

RESULT

Community service has been done by providing feeding aid on 17 babies with CLP at Mitra Sejati Hospital Medan and Grandmed Hospital Lubuk Pakam. Partners participated in this community service program by providing patient data information, and providing space facilities to perform the care of infants with CLP. The installation of feeding plates that are artificial palate in infants aims to allow the baby to drink normally. Most babies with CLP are unable to reach normal weight due to poor nutrition intake. Treatment of infants with this disorder is not only until the operation of the union of CLP alone but continues with comprehensive treatment among others for advanced dental care, speech therapy, and psychology.

DISCUSSION

Evaluation of the implementation of the program is carried out by the team to ensure the implementation of the program has achieved the specified objectives. The sustainability of the program is expected to be implemented continuously in the following years, because in Indonesia, especially in Medan, there are still many similar cases that are not handled properly due to lack of information and financial incompetence among the community.

Feeding plates were designed differently according to the diagnosis. Innovations were made in order to provide optimal results and support the normal growth of the baby's jaw.[2,5,6] The next stage is similar program will be carried out with the goal to help more CLP babies who need feeding plate through the publication of activities using social media and direct counseling to the community.

From this community service report, it is summarized that the counseling had a positive influence on knowledge about the consequences and treatment of CLP, as well as motivation to use the feeding plate. Feeding plates that are made in this community service program can help babies to eat or drink normally. Different feeding plate designs are innovations made in order to provide optimal results by taking into account the developing baby's jaw.

The continuation of this activity resulted in several suggestions; first, to increase the publication through social media so that information can reach all levels of society. Second, conducting direct socialization to the community through the Community Health Center so that more people can get information about CLP babies. Lastly, immediately check and bring the baby to the health center 2 days after birth. If it is found that the baby has CLP problems in babies can be overcome immediately.

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Esthetic rehabilitation of anterior tetracyline teeth using porcelain laminates veneers and porcelain fused zirconia bridge - a case report

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ABSTRACT
The increasing demand by patients for esthetic and metal-free restorations has driven the development of ceramic restorations with good esthetic and mechanical stability. The use of porcelain laminates veneers to solve aesthetic and or functional problems has been shown to be a valid management option especially in the anterior aesthetic zone. The current porcelain veneers are esthetically superior, conservative and durable treatment modality. The present case report describes the treatment of discoloured tetracycline teeth in the anterior dentition with thin porcelain laminate veneers and Yttrium-oxide partially stabilized zirconia (YTZP) bridge for missing upper right lateral incisor tooth and treated for problem. The restorations were evaluated clinically over for retention, colour match, surface texture, marginal integrity and gingival response. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up.
Keywords: tetracycline, porcelain, veneer, zirconia, aesthetics

INTRODUCTION

The increasing demand by patients for esthetic and metal-free restorations has driven the development of ceramic restorations with good esthetic and mechanical stability.[1] In daily clinical practice, aesthetics of anterior teeth is a common presenting complaint of patients, which is affected by caries, malformation, anatomic alteration, discoloration/staining, and hypoplastic defects.[1] Dissatisfaction with tooth color and shape has increased the demand for cosmetic dental treatment. Available options to restore unaesthetic teeth and create bright smiles consist of all porcelain restorasion and indirect veneer treatment.[2]

Porcelain veneers is a thin bonded ceramic restoration that restores the facial surface and part of the proximal surfaces of teeth requiring esthetic restoration.[3,4] The indications of dental veneers include 1) discoloured teeth due to many factors such as tetracycline staining, fluorosis, amelogenesis imperfect, age and others 2) restoring fractured and worn teeth, 3) abnormal tooth morphology, 4) correction of minor malposition 5) Intra-oral repair of fractured crown and bridge facings. Unfavourable conditions of dental veneers include 1) patients with parafunctional habits such as bruxism 2) edge to edge relation, 3) poor oral hygiene, and 4) insufficient enamel.[4–6]

The concept of no preparation or minimal-preparation has followed the development of appropriate enamel bonding procedures. The colour and integrity of dental tissue substrates to which veneers will be bonded are important for clinical success using additional veneers with a thickness between 0.3 mm and 0.5 mm, 95-100% of enamel volume remains after preparation and no dentin is exposed.[3,4] According to multiple clinical studies, porcelain veneers have excellent aesthetic results, the longevity of the treatment and patient's satisfaction.[4,5] Many studies investigated the longevity of porcelain veneers. They showed good results over a period of 10 years and more, with a survival rate of 96% after 10 years and 91% after 20 years.[5,7] Also, Smales and Etemadi reported a survival rate of 95% for porcelain veneers throughout 7 years.[5]

When there is missing tooth, the major factors that may influence the final restoration choice are esthetics and strength of the prostheses. Transformation-toughened zirconia is prone to be a successful alternative in the different clinical situations compared to other all-ceramic systems. Their mechanical and optical properties allowed them to be used as a framework material. In vitro studies demonstrated a flexural strength of 900–1200 MPa and a fracture toughness of 9-10 MPa.$m^{1/2}$. Nowadays, all ceramic prostheses are replacing, more and more, metal-based restorations. A variety of ceramic systems are developed for single crowns or fixed dental prostheses (FDPs) with an excellent esthetic outcome.[8]

Zirconia framework is esthetically better accepted than metallic framework, but it remains clinically too white and opaque. Therefore, manufacturers introduce colored zirconia framework to ameliorate the overall matching color. Different techniques have been proposed: adding pigments

to the initial zirconia ceramic powder, dipping zirconia milled frameworks in dissolved coloring agents, applying liner material to sintered framework. Thinner veneer is then required to mask the underlying framework.[8,9]

The present case report describes the treatment of discoloured tetracycline teeth in the anterior dentition with thin porcelain laminate veneers and porcelain fused zirconia bridge for missing right lateral incisor of maxillary arch to restore esthetics and function.

CASE

A-50-year-old female patient reported to the Department of Prosthodontics, Faculty of Dentistry University of Indonesia with a chief complaint of missing of upper right lateral incisor and discoloured anterior teeth. The patient was unhappy with the appearance of her teeth and restrained herself from smiling due to self-consciousness. Complete dental and medical history of the patient along with preoperative photographs was ta-ken.

A detailed family history, medical history and dental history was obtained. In family history, none of his family members had similar problem. Medical history was also not relevant. Extra oral examination could elicit no abnormal findings. Intraoral examination revealed no significant finding except amalgam filling in lower molars. The maxillary anterior exhibited variable degrees of pitting with yellowish to brownish discoloration of the surface (Fig. 1). All teeth were vital and had no hypersensitivity.

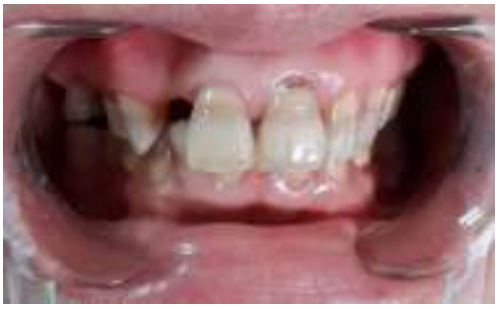

Figure 1 Initial condition of patient

The patient exhibited a canine guided occlusion, bilaterally. Following a careful evaluation of the objective parameters of the patient's smile, all treatment options were discussed. As the patient wanted fixed prosthodontic therapy, a conservative, aesthetic procedure using porcelain fused zirconia bridge and laminate veneers was selected. Porcelain laminates veneer for anterior maxillary segment from 21-24 and porcelain fused zirconia bridge for 11-13 was planned. Preparation for bridge 11-13 was planned after cementation of veneers because final colour of shade guide will be taken after control the veneers, because the colour after control was usually different because of the colour the cement we used.

MANAGEMENT

Pre-prosthetics and initial appointment

Diagnostic impressions were made using irreversible hydrocolloid (Aroma, GC), poured with type IV dental stone. Study models was used for wax up of the anterior teeth 13-24. In order to test the final outcome of the proposed smile design, the mock up was tested using Bisacryl composite material (Hantemp, Korea). After infiltration anesthesia was given, 0.5 mm depth cutting burs were used to achieve the required depth and were marked with a pencil. The preparation on the tooth was followed by tapered diamond bur (Laminate Veneer System-Set 4151, KOMET USA). Labial surface preparation was done until the pencil marks disappeared (Fig.2). The chamfer cervical preparation was made on the labial surface parallel to the gingival margin. In the proximal area, the chamfer marginal preparation was done without eliminating the proximal contact area, and the result of the preparation was smoothed with a finishing bur. After the preparation was completed, the entire tooth surface was then cleaned with pumice powder and water by using a rotary brush.

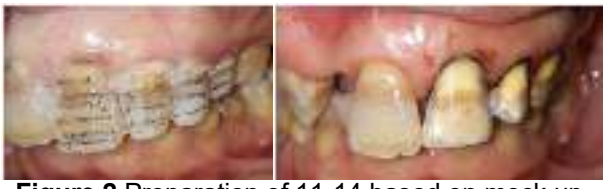

Figure 2 Preparation of 11-14 based on mock up

Gingival displacement was done (#00 cord with AlCl3 solution) and 2-stage final impression with addition polysiloxane was made (Aquasil, Dentsply Sirona) (Fig.2) and natural die shade guide was taken (Ivoclar, Vivadent) (Fig.3). After that, bite registration was conducted, and temporary veneer was made with Bisacryl composite material (Hantemp, Korea). Pressable ceramic, glass-ceramic lithium disilicate was used (IPSe. Max Press, Ivo-

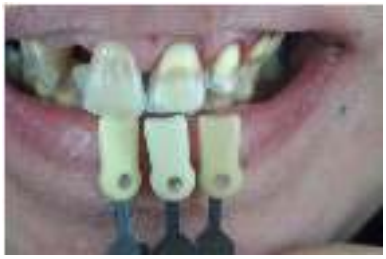

Figure 3 Shade guide selection

clar Vivadent). The try-in procedures were done after the temporary veneer was removed, and the occlusion was inspected. Veneer surfaces were cleaned, air-dried, and the silane coupling agent (Internal surfaces of the veneers were etched with 9.5% hydrofluoric acid (Ultra dent, Germany) for 20 second and were silanized with a silane coupling agent (Silane-Ultradent Products, Inc. South Jordan, Utah, USA).

Acid etching was done with 37% phosphorric acid (Total Etch, Ivoclar Vivadent) and the etchant was thoroughly rinsed off after a duration of 15 s. All the teeth surfaces and inner surface of veneers were coated with bonding agent in thin layer and light polymerized for 25–30 s. Dual cure composite luting agent (Variolink-II, Ivoclar) of appropriate shade was selected and placed in the inner surface of porcelain veneers (Fig.4). The cement excess was removed using an explorer, the veneer was cured for another 20 seconds on all aspects.

Figure 4 Veneer cementation

After veneer 21-24 was controlled, preparation for 11 and 13 was done and sharp angles of the preparation were rounded off, with shoulder marginal preparation. Gingival displacement was done (#00 cord with AlCl3 solution) and 2-stage final impression with addition polysiloxane was made (Aquasil, Dentsply Sirona). and natural die shade guide was taken (Ivoclar, vivadent). Shade was selected using Vitapan Classical shade guide (Vita Zahnfabrik, Germany) (Fig.5) based on last colour of veneer 21-24.

Figure 5 Shade selection for porcelain fused zirconia bridge 11-13

Trial and fitting of copping bridge 11-13 (Fig. 6A), the marginal fitness of coping and space for porcelain layering were checked, then final layering of porcelain was made in laboratory. Insertion for bridge 11-13; the cementation procedure was same as cementing the veneers. Dual cure composite luting agent (Variolink-II, Ivoclar) was used. Occlusion and lateral excursion were checked to ensure that no contact existed on tooth-porcelain interfaces. The patient was satisfied with her new emergence and smile (Fig.6B).

Patient was given instructions to daily flossing, additional use of a mouthwash, downward massage of the gums, and a 6-monthly follow-up was advised. There was considerable improvement in overall appearance of the patients in terms of aesthetics as seen in post rehabilitation photographs.

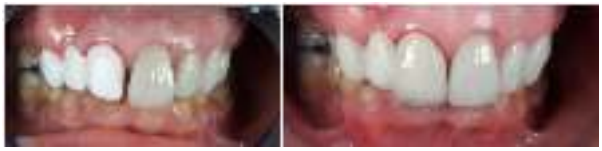

Figure 6A Trial copping bridge 11-13, **B** insertion bridge 11-13

The restorations were evaluated clinically over for retention, colour match, surface texture, marginal integrity and gingival response. The margin was smooth; there is no catch or penetrate of explorer. The restoration matches the shade and translucency of adjacent tooth tissues/veneers restoration. Patient is very satisfied with the color of restoration. There is no gingiva inflammation or visual evidence of gingival recession from restoration level. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up (Fig.7).

Figure 7 Folllow up after 1.5 years

DISCUSSION

Diagnosis is the first important stage in the treatment and it is important to design the future treatment planning. Thus, information about patient's motivation, patient's history of dental and general health, and patient's problems related with his/her daily habits should be explored as complete as possible. Future treatment plan is determined based on the clinic examination. The selection of material used will be based on both patients' expectation of care and their economic status.[10]

The selection of the indirect veneer 21-24 with porcelain material in this case is because it can give aesthetic and strength as same as those in the original teeth, such as the colour quite stable

and natural. Indirect porcelain veneer was indicated for the discolored and hypocalcified teeth, diastema, tooth-shaped correction, and tooth malposition which cannot be managed orthodontically. Porcelain veneers have also been proven to be highly effective for stabilising the colour of tetracycline stained teeth.[2] There are contraindications for porcelain indirect veneer, such as bruxism patients, inadequate enamel thickness for retention, severe tooth fracture, large diastema, shortened-crown tooth, teeth with large restoration, and severe tooth discoloration.[4,6]

Indirect porcelain veneers have more advantages than composite resin veneer because it has better esthetic, color stability, durable to withstand high abrasions, biocompatible, and non-porous. Therefore, plaque accumulation and its adverse effects on the gingival health can be minimized. Sowmya, et al stated that the advantages of porcelain veneers are resistant to plaque attachments, and the preparation was limited to the enamel to protect the tooth structure underneath. Maintaining sound tooth structures as much as possible are an essential part that should be considered in the dental restoration.[4]

In this case, preparation teeth for veneers are performed on the mock-up as if it was a natural tooth, which was called the mock up driven technique. This technique results in considerably less invasive dental preparations, since it takes into account the final contour desired for the veneer.[3] The use of the mock-ups, followed by a wax-up, and silicone index for checking the preparation will not only allow the dentist to achieve the best aesthetic, phonetic and functional outcome, but also to communicate this to the patient, and laboratory.[11]

For the missing tooth 12, Yttrium-oxide partially stabilized zirconia (YTZP) was choosen as the material. Zirconia framework is esthetically better accepted than metallic framework, but it remains clinically too white and opaque.[8] Based on the aesthetic demands that increase the interest for non-metallic and biocompatible restorative materials and with the development of zirconia based prostheses, YTZP became commonly used for anterior teeth when the abutments were discoloured, or for opaque teeth.[9] The clinical techniques and aesthetic-driven sequence for an outcome-based protocol that enhances therapeutic cohesiveness in failed crowns, and ensures the sequential transfer of design objectives for the improvement of aesthetics must be understood. An opaque zirconia core overlaid by translucent enamel has a more natural appearance, and provides greater aesthetic results.[9]

In addition, the success of the aesthetic restoration treatment on the anterior teeth related with the satisfaction of patients towards the results obtained is also determined by the communication not only between dentist and patient, but also between dentists with the laboratory technician. Instruction after the insertion process must be informed to the patient. Besides that, patient was informed to avoid eating hard foods and chewing excessive burden then asked to come to control a week later, and to have regular control every 6 months.

It is concluded that aesthetics is very subjective and necessitates excellent communication between the dentist, patient and ceramist. The case has to be carefully selected and treatment planned. Indirect porcelain veneer is an alternative treatment that can conservatively improve the aesthetic appearance by taking the enamel tissue as little as possible and leaving the healthy tooth tissue as much as possible. Yttrium-oxide partially stabilized zirconia bridge merges excellent aesthetic quality with outstanding toughness. The patient was very satisfied with the result and had no complaints during 1.5 years of follow-up.

So, it is suggested that diagnosis is the first important stage in the treatment and it is important to design the future treatment planning. Future treatment plan is determined based on the clinic examination. The success of the aesthetic restoration treatment on the related anterior teeth is also determined by the communication between dentists and patients, and between dentists with the laboratory technician.

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The effect on color and dimensional stability of heat cured acrylic resin denture base after being immersed in chocolate and tea drinks

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ABSTRACT
The denture base is an important part because it acts as a support for the tissue around the tooth. Optimal support and aesthetic result in the manufacture of denture bases require several considerations. Color and dimensional stability are one of the important factors for denture bases. In this experimental laboratory study, the denture base was immersed in chocolate and tea drinks and measured the color and dimensional stability before and after immersing. Colorimeter is used as a measurement device for color stability and digital calipers as a measurement device for dimensional stability. The mean differences in color and base dimensions of the dentures were tabulated and the Kruskal-Wallis test was used to analyze them. The results showed that there were very high differences in color and dimensions of immersing tea drinks.
Keywords: color stability, dimensional stability, chocolate, tea

INTRODUCTION

The base of denture is an important part because it acts as a support for tissue around the tooth.[1-3] One of the materials that is often used is acrylic resin. There are various types of acrylic resin, namely heat polymerizing acrylic resin (HPAR), self-polymerizing acrylic resin, light polymerization acrylic resin and microwave polymerization resin. The type of acrylic resin that is often used is HPAR, which began to be used since 1946 because it has several advantages, namely fulfilling aesthetic requirements, good color stability, non-irritating, non-toxic, relatively cheap price, easy to manipulate and repair.[4,5]

The HPAR dentures usually need to be technically cleaned which is brushing and chemically cleaned by immerse the denture in cleaning solution at night for 6-8 hours. Despite having many advantages, there are also some disadvantages of HPAR such as loss of resistance, discoloration, porosity and dimensional changes can occur in clinical use.[6-7] Within a certain period of time HPAR has a tendency to absorb fluids because during HPAR polymerization, porosity possibly occurs on the surface of HPAR.[8] This will continuously have an impact on color and dimensional stability so patient would feel uncomfortable and could get psychologically disturbed because of improper aesthetic.[8] The HPAR undergoes changes in dimensional stability during polymerization such as in terms of shrinkage or expansion where it could impact the patient's occlusal.[9-12] Color of the denture base is very important because it affects aesthetics. The denture base material must have optimal color stability because it is often exposed to various types of food and drink in the oral environment.

Acrylic resin can absorb stains over time, and the resin material is adhesive to liquid molecules which during the abrasive process causes a color change.[13] This is a big minus of acrylic resin, because the change occurs gradually over time.[13] This change is caused by intrinsic or extrinsic factors. Intrinsic factor occurs when there is a change in chemical composition, material composition or material formula, extrinsic factors happen on pigmented foods and drinks intake.[13,14] Various types of beverages on the market that have ability to interfere with the stability of the color and dimensions of the denture base. Some of these drinks are tea and chocolate. Consumption of chocolate and tea drinks is common because it has high calories and can increase energy.

Based on that fact, this study is aimed to determine the effect of immersion of the HPAR denture base in chocolate and tea drinks to check the color and dimensional stability changes.

METHODS

Preparation of HPAR samples

The produced HPAR sample, obtained from stainless steel model with measurement circular diameter of 50x0.5 mm for measure color stability and 64x10x3.3 mm for measure dimensional stability. The first step was making a mold from a hard gypsum dough with ratio of the plaster to water is 300 g:90 mL. The dough was stirred with a spatu-

la for 15 seconds until it became homogeneous. Then place the dough into prepared cuvette while it was placed the cuvette on a vibrator. The stainless-steel model sample was placed on top of the gypsum dough which was hardening inside the cuvette.

After slightly hardens, the plaster was trimmed and allowed to stand until it hardened completely. The surface of the plaster and the cuvette was smeared with vaseline, then the cuvette was paired and filled with hard gypsum dough on top of the vibrator. After the cast hardens, the cuvette opened, the stainless-steel model sample was removed, the cuvette was poured with hot water to remove the remaining vaseline until clean.

Filling acrylic resin in the mold

The polymer and monomer were stirred in a pot ratio of 2 g:1 mL according to the manufacturer's instructions and wait for the mixture to reach dough stage. The mold that had been smeared with a separator was filled with acrylic resin dough. Thin plastic slide was placed between the top and bottom cuvettes, then closed and gently pressed with a hydraulic press with a pressure of 1000 psi (70 kg/cm^2). The cuvette was opened and cut the excess of acrylic layer then the cuvette was closed again, pressing with a pressure of 2200 psi (154 kg/cm^2) then bolts were fixed.

Curing

Curing unit was filled with water, temperature and time were set to phase I 70ºC for 90 minutes and phase II 100ºC for 30 minutes. The cuvette was removed from the water bath and allowed to cool to room temperature.

Final procedure

The samples were removed from the cuvette, then trimmed to remove sharp parts using a fraser bur with a rotary grinder and sand paper type AA 240 to obtain the desired size.

Procedure for making chocolate drinks

The chocolate drink was *Delfi* cocoa powder of which 5 g was dissolved in 625 mL of boiling water then 500 mL of the solution was precipitated. The drink was allowed to cool before immersion. The drink was placed in a room temperature environment and immersion was carried out for 7 days, assuming 7 days are identical to usage for 2 years. One consumption took 15 minutes. Immersing for 7 days means 7x24 hoursx60 minutes = 10080 minutes divided by 15 minutes/day = 672 days; identical to 2 years of use to measure color stability. Immersing was carried out for 92 hours, that are identical to that of 1 year of use. One consumption takes 15 minutes. Consumption of 92 hours means 92 hoursx60 minutes = 5520 minutes: 15 minutes/day = 368 days which was identical to 1 year of use to measure dimensional stability.

Procedure for making tea drinks

Two *Sari Wangi* tea bags dos 2x2 g were immersed in 200 mL boiling water for 1 minute. The drink was allowed to cool down before starting immersing. The drink was placed in a room temperature environment and immersed for 7 days, assuming 7 days was identical to 2 years usage. One consumption takes 15 minutes. Immersing for 7 days means 7x24 hoursx60 minutes = 10080 minutes: 15 minutes/day = 672 days identical to 2 years of use for the measurement of color stability. The resin was immersing for 92 hours, it is assumed that 92 hoursare identical to that of 1 year of use. One Consumption takes 15 minutes. Consumption of 92 hours means 92x60 minutes = 5520 minutes: 15 minutes/day = 368 days identical to 1 year usage for dimensional stability measurements.

Color stability measurement

Sample color was measured before and after immersion using a colorimeter after rinsing with distilled water. Immersion was carried out for 7 days. Drinks were changed every 3 days. The samples were divided into 3 groups, namely A immersed in chocolate drink, B immersed in tea drinks, and C immersed in distilled water. The colorimeter was set to measure mode and placed perpendicular to the sample surface. The instrument was held in the direction against the 90^0-surface center of the sample and the test button was pressed until the machine beeped to indicate the completion of the measurement and the result was displayed on device screen. The results were displayed in L*a*b format. Each reading was repeated three times by the researcher to obtain identical readings, so that an average was recorded.

Dimensional stability measurement

Measurement of changes in dimensional stability was carried out before and after immersion, and the surface area of the sample was calculated. Each end of the sample was marked A, B, C, D. Measurement of dimensions after immersion was the final value measured using a digital caliper. The reading was included in the vector formula, namely $v \| = \sqrt{AB2 + BC^2 + CD^2 + DA^2}$.

Data analysis

The data were analyzed with descriptive test to determine average standard deviation of each group. Then, the changes in the stability of the denture base material of HPAR in immersion of chocolate and tea drinks was determined by the Kruskal-Wallis test and continued with the Mann-Whitney test to find out the differences between groups.

RESULT

The results indicated the color stability value of the HPAR denture base in chocolate immersion was 2.283. The smallest color stability value in immersion of a resin denture base chocolate drink was 1.13, while the largest value was 3.58. The value of the color stability of the base color of HPAR dentures in tea immersion were 4.630, while the smallest value was 1.87 and the largest value was 6.42. The value of immersion in distilled water is 0.663. The smallest color value was 0.35 and the largest value was 1.4.

The mean value and standard deviation of color stability for HPAR denture base immersed in a chocolate drink was 2.283±0.865, while the mean value and standard deviation of color stability for HPAR denture base immersed in tea was 4.630± 1.709. The standard deviation of the color stability of the HPAR denture base immersed in distilled water was 0.663±0.45.

The dimensional stability value of the HPAR base was obtained by recording the results of each sample using a digital caliper. They indicated the value of the dimensional stability of the HPAR base in chocolate immersion is 0.261. The smallest dimensional stability value of immersion the resin in chocolate drink was 0.09 while the largest value was 0.17. The dimensional stability of the HPAR denture base in tea immersion was 0.277. The smallest value is 0.23 and the largest value is 0.31. The value of immersed in aquadest, was 0.055. The smallest color value is 0.04 and the largest value is 0.06.

The dimensional stability of the HPAR denture were analyzed using descriptive test. The mean and standard deviation of the dimensional stability of the HPAR denture base immersed in a chocolate drink was 0.261±0.413, while the mean and the standard deviation of dimensional stability of the HPAR denture base immersed in tea drinks was 0.277±0.023. The mean and standard deviation of the dimensional stability of HPAR denture base immersed in aquadest was 0.05±0.012.

DISCUSSION

A colorimeter which is a light sensitive instrument used to measure the color intensity of an object or the color of a sample in relation to the red, blue and green components of light reflected from the object (table 1). The values in group A1 were 2.283±0.865 and group B1 was 4.630±1.703. The

Table 1 The color stability value of HPAR denture base after immersing in chocolate drink, tea drink and aquadest

No sample	Group A1 ΔE (L * a * b *)	Group B1 ΔE (L * a * b *)	Group C1 ΔE (L * a * b *)
1	1.13 *	3.90	0.98
2	2.20	5.43	0.90
3	1.99	6.42 **	0.78
4	1.42	6.16	0.75
5	3.58 **	3.90	0.35 *
6	2.2	1.87 *	0.36
7	2.62	6.16	1.4 **
8	1.99	5.43	0.48
9	3.58	2.18	0.36
X ± SD	2,283 ± 0.865	4,630 ± 1,709	0.663 ± 0.451

Table 2 The dimensional stability value of denture base after immersing in chocolate drink, tea drink and aquadest

No sample	Chocolate	Tea	Distilled water
1	0.11	0.27	0.06 **
2	0.14	0.28	0.06
3	0.17 **	0.23 *	0.05
4	0.16	0.29	0.04 *
5	0.09 *	0.27	0.06
6	0.09	0.31 **	0.06
7	0.3	0.26	0.06
8	0.13	0.29	0.05
9	0.13	0.3	0.05
X ± SD	0.261 ± 0.413	0.277 ± 0.023	0.05 ± 0.012

value in the C1 group was 0.663±0.451. The color stability values in groups A1, B1 and C1 were varied and the normality test was performed. Based on the results of normality testing using the Shapiro-Wilk test, it was found that all data were not normalmally distributed, so test was continued by using the Kruskal-Wallis test to determine the effect of immersion of HPAR denture bases in groups A1, B1 and C1 on color stability with the Kruskal-Wallis test. The statistical test results obtained a significant level of p = 0.001 <0.05 indicating that there was an effect of immersion of the HPAR denture base with group A1, group B1 and group C1 on color stability. The results of statistical tests from this study indicated that there was an effect of immersion of the HPAR denture base with group A1 (chocolate) and group B1 (tea) on color stability. Judging from the change in the color stability value group B1 was the highest while group C1 showed the least change in color stability. This difference proved that the C1 (control) group had no effect of immersion in the base of HPAR dentures on color stability. Judging from the change in the color stability value group B1 was the highest while group C1 showed the least change in color stability. This difference proved that the C1 (control) group had no effect of immersion in the base of HPAR dentures on color stability. Judging from the change in the color stability value group B1 was the highest while group C1 showed the least change in color stability. This difference proved that the C1 (control) group had no effect of immersion in the base of HPAR dentures on color stability.

Group A1 shows a moderate change in the value of the color stability. There are many benefits of chocolate drink because of the bioactive components of cocoa (flavonoids, saponins, catechins) namely preventing the initiation of pellicle adhesion. The contents of flavonoids as antibacterial and antifungal, saponins prevent the attachment of *C.albican*.[2] However, there are several disadvantages such as changes in color stability of the HPAR denture base. This is because the dissolved component undergoes diffusion capillary flow into the HPAR. The color change occurs due to the physical penetration of the pigments between the latic molecules or the absorption of the pigments on the HPAR surface. There were significant differences between the control group and the treatment group. It was suspected that there was a tannin component from the brown solution with a double bond conjunction on the polyphenol which functioned as a chromophore (color developer) and the presence of a (OH) group in the tannin functioned as an auxochrome (color binder). The presence of chromophores and auxochromes in tannins can cause a brown color. This finding supports Craig et al that stated natural substances absorbed by the resin will cause color changes.

Group B1 showed a change in the value of high color stability. Tannin which was a dye contained in tea drinks where it is highly chromogenic, was a major factor in the occurrence of color pigmentation. The color change took effect after immersion due to the deep absorption of the dye. Then tea drinks also contain large amounts of flavonoid which give tea and flavor properties. However, the aflavins in tea leaves were reported to be the cause of the discoloration.[12] Um and Ruyter reported that tea caused more discoloration than coffee after 48 hours of storage of the five based ingredients resin in a coffee and tea solution.

Based on the results of the Mann-Whitney test, there was a significant difference between groups A1 and C1 (p=0.001 <0.05). There was a significant difference in light intensity between groups B1 and C1 (p=0.001 <0.0) and between groups A1 and B1 (p=0.004 <0.05). Based on the Mann-Whitney test, the results of group B1 had the most significant difference. This was because the tea drinks contained 1% tannin value and 15% flavonoids.

The values in the A2 group were 0.261±0.413 and the B2 group was 0.277±0.023. The value in the C2 group was 0.055±0.012. The values for dimensional stability in the A2, B2 and C2 groups were varied and were tested for normality. Based on the normality test using the Shapiro-Wilk, it was found that all data were not normally distributed, so the test was continued using the Kruskal-Wallis test to determine the effect of immersion of HPAR denture bases in A2, B2 and C2 groups on dimensional stability. The statistical test results obtained a significant level of p=0.001 <0.05, indicating that there was an effect of immersion of the HPAR denture base with the groups A2, B2 and C2 on dimensional stability. The results of statistical tests from this study indicated that there was an effect of immersion of the HPAR denture base with group A2 (chocolate) and group B2 (tea) on dimensional stability. Judging from the change in the value of dimensional stability group B2 was the highest, while group C2 showed the least change in dimensional stability. This difference proved that the C2 (control) group had no effect of immersion in the base of HPAR dentures on dimensional stability. Judging from the change in the value of dimensional stability group B2 was the highest, while group C2 showed the least change in dimensional sta-

bility. This difference proved that the C2 (control) group had no effect of immersion in the base of HPAR dentures on dimensional stability. Judging from the change in the value of dimensional stability group B2 was the highest, while group C2 showed the least change in dimensional stability. This difference proved that the C2 group (control) had no effect of immersion in the base of HPAR dentures on dimensional stability.

In group A2 the dimensional change was moderate; the water molecule combined in the macromolecular structure of HPAR which extended the chain of bonds of the PMMA group. Shrinkage and expansion were two dimensional changes that can not be avoided in any HPAR material. Ferrance stated that materials containing ester and ether groups have hydrophilic properties so that they easily absorbed solutions.

Group B2 gave the highest change because immersing the sample in tea solution resulted in a high dimensional change. This was because it was acidic compared to the control group. It was suspected that the acidic tea reacted with HPAR causing chemical damage to the surface of the acrylic resin. The result of exposure to acidic solutions can cause the release of ions contained in the HPAR, causing surface irregularity.[5] Acidic tea solutions could cause erosion on the HPAR surface. This finding follows Shakhashiri's research which states that the erosive power of acids depends on the type of acid contained in the drink. Acid solutions are also degradable from acrylic resins. This effect was discussed in the matrix decomposition timeframe. Matrix decomposition could occur due to hydrolysis of the matrix. Methacrylic acid has been produced as a result of the degradation process caused by matrix polymers. The degradation process was related to the absorption of the solution and swelling from the matrix which caused the release of organic substances and resulted in mass loss, the change in dimensions of the acrylic resin.

Based on the Mann-Whitney test, the B2 group had the most significant difference in dimensional stability. This is because the content of the drink has acidity properties.

It is concluded that there is an effect of immersion of HPAR denture base with chocolate drink and tea drink on the value of color stability; the effect of tea drinks is more on changes in the color and dimensions stability of the HPAR.

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Prosthodontic procedural treatment consideration in pandemic situation: a review

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ABSTRACT
The global spread of the coronavirus disease has put dentists, dental specialists, and staff, as well as patients, at danger of COVID-19 infection during dental procedures. The COVID-19 risk associated with prosthodontic dental treatment operations might range from low to very high. This article provides a helpful guide to prosthodontic treatment processes, including infection control and standards of care.
Keywords: prosthodontic, COVID-19, pandemic

INTRODUCTION

The recently discovered coronavirus disease (COVID-19) that was first diagnosed in China has become pandemic as declared by World Health Organization due to its rampant spread throughout the world. This pandemic has affected every sector of human life worldwide and become international health crisis.[1,2] The symptoms of COVID-19 mostly include fever, myalgia, fatigue, coughing, and shortness of breath or dyspnoea along with abnormal chest x-ray diagnosed with lesions in multiple lung lobes.[3] Everyone is equally prone to this infection because of its transmission through air droplets that are transmitted by patients who cough and sneeze. People who are asymptomatic redundant could also be able to transmit the virus when in contact with other people.[4] Recently saliva of infected patients was found to contain COVID-19 virus. This can have a major role in the transmission of the virus.[5]

Due to the transmission of SARS-CoV-2 with long incubation period and possibilities of aerosol produced also oral fluids contact during dental procedures, both the dental healthcare professionals as well as the patients were put at high risk of cross infection.[1,6] Prosthodontist is going to face much more challenges because of high concentration of saliva contained in trays and dentures, also blood exposure during pre-prosthetic surgeries, implant placement and exposure to aerosols during tooth preparation for crown and bridge. Almost every prosthodontic treatment demands multiple visits by patients, which throws a unique challenge to ensure bilateral safety at every visit. As a result, the dental services were limited to the emergency and urgent cases during the early days of the pandemic.[2,4,6]

Dental laboratory service is an important feature of prosthodontic practice. Unlike other dental specialties, dental laboratory support is required in any type of prosthodontic care, from full dentures to partial dentures, crowns to bridges. It's critical to remember that dental laboratory work entails cooperation of the practitioner, assistant, laboratory supervisor, laboratory technician, and ending with the runner and doctor. The likelihood of contamination increases as the possibility of interaction between the team grows. Thus it is considerable for patients also practitioner to understand heatlh protocols and personal prevention as we arrive in dental clinic.[6]

Coronavirus

Coronavirus is an RNA virus with a diameter of 60-140 nm and spikes that give it a crown-like appearance, hence the name coronavirus. A few patients with serious pneumonia were presented to a hospital in Wuhan, China in December 2019.[4] This disease originated in Wuhan's wholesale seafood market, which also marketed wild animals. Coronavirus was described as having a 95% similarity to the bat coronavirus and a 70% similarity to the SARS-CoV. Human-to-human transmission began to occur later. Cases gradually increased, and it was discovered that this disease had a 1.8-day dou-bling period.[4,6]

Pathogenesis of COVID-19

Adults and children of all ages are equally prone to this infection as the incubation period is generally from 0-24 days, hence person to person transmission may occur before any symptoms are seen in the patient. In the beginning of this virus outbreak, it was believed that coronavirus transmis-

sion may also be spread by touching surfaces and objects as in Fig. 1. Later on, WHO announced that transmission can occur more easily in the "Three C's" which consist of crowded places with many people nearby; close-contact settings, especially where people have conversations very near each other; also confined and enclosed spaces with poor ventilation.[2,7]

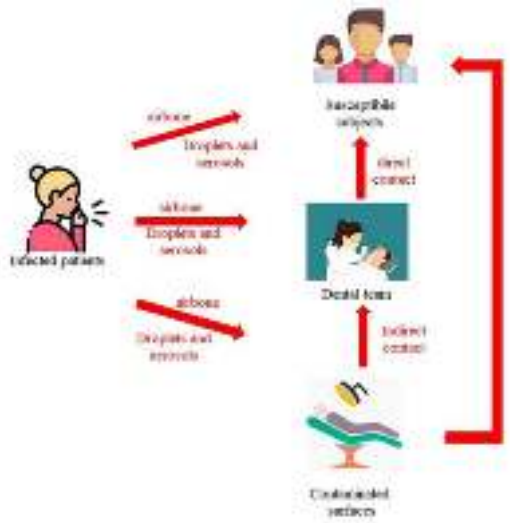

Figure 1 Three main routes for transmission of infectious agent (Source: Bizzoca ME, Campisi G, Muzio L Lo. Covid-19 pandemic: What changes for dentists and oral medicine experts? A narrative review and novel approaches to infection containment. Int J Environ Res Public Health. 2020;17(11))[9].

Thus, disinfecting surfaces and regular washing hands are critical for preventing the spread of this disease. Several studies show people touch their faces regularly, on average 23 times per hour, and 44% of those include touching the mucous membranes of nose and mouth. As a result, hand washing with soap or hand rubbing with sanitizer should be done on a regular basis to prevent this transmission.[4]

Previous studies stated that angiotensin-converting enzyme-2 (ACE2) transmembrane receptors are found in the oral epithelium and salivary glands.[8] SARS-CoV-2 can penetrate saliva through three different routes: liquid droplets or drainage expectorate from the upper or lower respiratory tract that enter the oral cavity, serum containing the virus that leaks from inflamed gingival tissues into gingival crevicular fluid, and major and/or minor infections of the salivary gland(s).[9,10]

Aerosol-producing procedures in dental offices are a major source of concern. Fortunately, there is no evidence that the SARS-CoV-2 virus survives for long periods of time in the localized air flow. However, van Doremalen et al demonstrated that the SARS-CoV-2 remained viable, within the aerosol, for 3 hours after being aerosolized.

To avoid the development of infectious saliva droplets, it's crucial to decontaminate indoor air, ensure proper air flow, and prevent cross-contamination through saliva droplets. These three acts, especially in the dental environment, can help to slow the spread of SARS-CoV-2.[5,6]

The protective measures that should be done in a dental context can be classified into the following categories, according to the COVID-19 recommended criteria 1) prior to dental therapy. Before entering dental office, dental team must provide patient triage. Identification of likely suspects, postponement of non-urgent dental care, appointment management, and active screening of dental staff are some safeguards that should be addressed before a patient enters the dental clinic.[2] Active patient screening, control of social distance in the dental office, providing sanitation steps to patients, use of facemasks by everyone in the dental office, patient education, use of personal protection equipment (PPE) by the dental team, and management of the dental operatory room are several procedures that are also necessary at dental offices during this pandemic situation;[9] 2) during dental therapy. During the treatments, clinicians must maintain hand hygiene, offer patients a preoperative antimicrobial mouth rinse, utilize rubber dams, high-volume saliva ejectors, and extraoral dental radiographs, implement 4-handed dentistry, avoid aerosol generating operations, one-visit therapy, and environmental cleaning and disinfection processes;[2,11] and 3) after dental therapy.[2] Following the treatment, cleaning and disinfecting reusable face protective equipment, as well as managing laundry and medical waste, should be considered.[10]

The complete clinical setup has been proposed to have distinct places for donning/doffing, a separate sterilizing room, and the segmentation of regions into distinct zones, as per the necessity of the hour. Its viability is contingent on basic infrastructure, total available space, number of auxiliary staff, and daily patient reporting.[7]

ZONE A: reception and waiting area

This section is for gathering basic patient information utilizing particular clinic or institution-based protocols. This zone requires non-contact temperature recording, sensor taps, and contactless sanitizing dispensers.[3]

The patient is asked to take off any jewelry, watches, or other valuables and carefully sanitize their hands. Due to the standard of keeping physi-

cal distance, one attendant per needy patient is preferable. A triple layer facemask, disposable shoe covers, head cap and gloves should be provided to the patient. To prevent the passage of droplets between the patient and the staff, a glass barrier might be installed at the reception desk. The patient should complete a screening form as well as an informed consent form.[6]

Posters can be produced and exhibited to educate patients about hand hygiene, respiratory etiquette, and other topics. A pulse oximeter is a non-invasive, wireless finger tool used in the screening area to track substantial changes in arterial oxygen saturation in a fraction of the time, especially in asymptomatic people. If the oxygen saturation is less than 93%, a physician should be consulted for further examination. Other guidelines to follow include non-overlapping appointments with at least a 15-minute break, physical distancing, and digital payments.[8]

ZONE B: Screening area

In this zone, initial screening and diagnosis will be performed with sterilized devices. At the outset of the disease, the viral load is at its highest, mostly in the upper respiratory tract. According to Bidra et al, a pre-procedural mouth rinse utilizing a 0.5% concentration of oral Povidone-Iodine (PVP-I) for at least 15 seconds can totally deactivate the virus.[4,7]

Povidone iodine's significant virucidal activity can be efficiently utilized by using it as a mouth gargle against COVID-19. To avoid salivary contamination, orthopantomogram and cone-beam computed tomography (CBCT) are advised instead of intraoral radiographs during this period. It is preferable to take digital radiographs in-house rather than sending patients outside.[7]

ZONE C: Non-aerosol generating area

This section features dentists doing operations that do not require the use of handpieces or ultrasonic scalers. As a result, hand equipment such as spoon excavators and chemical-based caries removal solutions are prioritized. Within the limits of administrative and environmental constraints, PPE is the only effective strategy for preventing the transmission of infection. Donning and doffing should be performed in the designated regions in a systematic manner. As previously noted, four-handed dentistry with a digital workflow is recommended.[1]

ZONE D: aerosol generating area

Aerosols are described as particles with a diameter of less than 50 µm created by the use of high-speed hand pieces. Aerosols are said to have a tendency to stay suspended for at least 30 minutes after the operation is over, and can travel up to 2 feet from the dental chair. Because the risk of transmission is considerable in this location, and the false negative rate of Covid Antigen tests is over 30%, universal precaution is required. Only the most essential items should be kept out in the open, with the majority of the material and instruments being maintained in closed cabinets.[6,9]

DISCUSSION

Dentists have an ethical commitment to treat patients even in emergency situations, as well as a personal commitment to keep their families and employees safe. This article will be concerning on prosthodontic treatment in pandemic situation. The prosthetic dental treatment procedures can be categorized as seen in Table I, from Rokaya[3] quoting Alharbi et al.

Removable prosthodontics

This comprises complete and partial denture creation. As a result, before initiating any geriatric patient, a detailed medical case history is required to assess risk against need benefit. To minimize unintended consequences, it is vital to prioritize

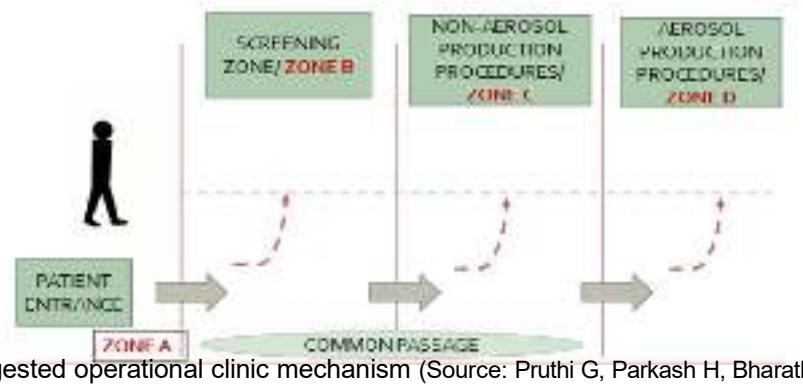

Figure 2 Suggested operational clinic mechanism (Source: Pruthi G, Parkash H, Bharathi PV, Jain R, Gupta A, Rai S. Comprehensive review of guidelines to practice prosthodontic and implant procedures during COVID-19 pandemic. J Oral Biol Craniofacial Res [Internet]. 2020;10(4):768–75. Available from: https://doi.org/10.1016/j.jobcr.2020.10.010)[1]

Table 1 Common urgencies in prosthodontic treatment[3]

	Urgent Treatments			
Emergency Treatments	Managed with Minimally Invasive Procedures and Without Aerosol Generation	Managed with Invasive and/or Aerosol-Generating Procedures	Nonroutine Treatments	Routine Treatments
• Pain with diffuse infection-causing extraoral and/or intraoral swelling that can compromise the patient's airway	• Fractured prosthesis or soft tissue trauma from denture • Cementation of crown or bridge • Severe pain from tooth fracture from biting or trauma • Severe pain from pulpal infection or inflammation • Localized dental/periodontal abscess	• Fracture of removable or fixed prosthesis causing soft tissue injury • Debonded fixed prosthesis cleaning and cementation • Severe pain from tooth fracture that need to be managed by generating aerosol • Severe pain from pulpal inflammation that need to be managed by generating aerosol • Removable dentures adjustments for radiation therapy patients	• Removable dentures adjustments or repairs for normal patients • Asymptomatic fractured or defective restoration or prosthesis • Chronic periodontal disease	• Examination of the fully edentulous patient • Restorative treatments • Aesthetic dental procedures • Teeth bleaching • Dental implant surgery

Sources: Alhurisi, Alharbi, and Alqaidi (2020).

the completion of ongoing proceedings over the start of new cases. Before repairing a fractured prosthesis, it should be thoroughly disinfected. Ulcerations or mucosal erosions can be treated via teleconsultation by prescribing analgesic and antiseptic gels for topical application and temporarily removing the prosthesis.[8] If the patient is unable to see the clinic, mild smoothening of sharp borders may be recommended. A low-speed micromotor should be used to adjust dentures. If the patient's systemic health is being harmed, a new prosthesis should be made. Primary impressions should be taken in well-fitting stock trays, while subsequent impressions should be taken in custom trays that may be discarded once the master cast has been obtained. To save chair side time, one-step border molding might be used.[1,2,12]

As for laboratory procedure, in order to avoid any changes following insertion into the mouth, record bases and wax rims should be adjusted beforehand. Dentures should be remounted to adjust occlusion and processing errors should be avoided in the lab. This will minimize patient follow-up visit.[9]

Fixed prosthodontics

Crowns and bridges, inlays and onlays, smile design, veneers, complete mouth rehabilitation, post and cores, and other fixed prosthodontic procedures are all part of fixed prosthodontics. These are processes that produce aerosols. As a result, significant safety and disinfection measures must be followed. Digital intraoral scanner impressions are a safe option; however, the cost-benefit ratio must be considered.[4]

During dental preparations with supragingival margins, a rubber dam and strong vacuum suction are indicated. This successfully removes the majority of blood and saliva particles while also lowering the virus load. In their tooth preparations, dentists should avoid undercuts and underreduction.[6]

The patient's agreement should be obtained before using a digital gadget to match shades. To avoid any shade mismatch, intraoral pictures can be transferred to the laboratory via the internet. Crown removers should be used to remove a damaged prosthesis. Recementing the dislodged prosthesis is possible, but the temporary crowns should be adjusted extra-orally with a micromotor.[11]

Additional imeasures include the dentist's working position being 11–12 o'clock, lower air pressure in 3-way syringes, full PPE for both the doctor and the assistant, and the use of anti-retraction hand pieces and disposable burs. Rinsing and spitting on a regular basis should be discouraged. The propagation of the virus can also be aided by fomites. As a result, impressions, which can be used to transmit cross contamination, should be disinfected (sodium hypochlorite 1% for ten minutes) and stored in disposable pouches.[4,9]

Implant surgery & prosthodontics

These days, implant dentistry is the most exciciting and lucrative division for prosthodontists. However, implant treatment planning necessitates many dental visits, which, along with the use of surgical aerosol-generating handpieces, necessitates extraordinary caution in terms of infection control and disinfection. Authors encourage that

you follow their advice, but personal discretion is required.[6]

On the basis of CBCT, healthy patients with no other co-morbidities can be accepted. Slow speed drilling with sharp drills is preferred during surgery. External irrigation with high volume suction should be done on a regular basis. Ultrasonic instruments and piezoelectric surgery should be avoided, while the use of osteotomes should be encouraged to decrease the creation of aerosols.[1]

Immediate implants with immediate loading should be used wherever possible because they require fewer visits. Complex full mouth operations should be avoided wherever possible. As an alternative to traditional impression production, a digital impression with scan bodies is recommended. Before reusing implant impressions and components, any implant component must be thoroughly disinfected or autoclaved,[3,4] and the prosthodontists must prevent repetition of any chairside step.[1]

It was concluded that during prosthetic dental treatments, dentists, dental assistants, dental staff, and patients are all at risk for COVID-19 infection. The COVID-19 risk associated with prosthetic dental treatment operations might range from low to very high. As a result, prosthodontic/prosthetic dental treatment operations should be performed with high levels of care and infection control. Furthermore, there are still minimum evidence-based recommendations, but all of the relevant information on this topic have been compiled so that safe and update services to the patients have been provided while also protecting the clinicians from the virus.

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Front teeth replacement with implant-supported crowns: A case report

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ABSTRACT
The use of dental implants to support fixed or removable restoration is widely used as treatment modality. The advantages are increased retention, chewing ability, and easy access to oral hygiene procedures. A missing tooth that needs to be replaced completely can be restored using an implant-supported crown. The aim of this study is to rehabilitate maxillary partial edentulous with implant supported crown. A 56-year-old female patient came to the clinic, wanted to replace partial edentulous after extraction of 11 and 21, needed fixed restoration in order to eat and chew well, and expected high aesthetic result as well. This patient had experienced using removable partial denture to replace her lost teeth. Patient wanted to have implant treatment with fixed restoration because she felt that her partial denture did not fit anymore, so the prosthodontic treatment option was using implant-supported crowns. Implant supported crown can be an option to replace partial edentulous.
Keywords: implant supported crown, fixed restoration, dental implant

INTRODUCTION
Nowadays, dental implants represent a reliable treatment option in oral rehabilitation of partially or fully edentulous patients in order to secure various kinds of prostheses. Dental implants have become a standard procedure for single tooth replacement in the esthetic zone, providing many advantages but also challenges in sophisticated patients.[1]

Today, roughly 1300 different implant systems exist varying in shape, dimension, bulk and surface material, thread design, implant-abutment connection, surface topography, surface chemistry, wettability, and surface modification. The common implant shapes are cylindrical or tapered. Surface characteristics like topography, wettability, and coatings contribute to the biological processes during osseointegration by mediating the direct interaction to host osteoblasts in bone formation.[1]

Several techniques have been developed to eliminate bone deformities including bone grafting, guided bone regeneration, distraction osteogenesis, use of growth factors and stem cells.[2] Similar cases of bone defects can be treated differently according to the surgeon's preference.

The aim of this study is to report a case of rehabilitation a maxillary partial edentulous with implant-supported crowns.

CASE
A 56-year-old female patient came to the clinic and wanted to replace her partial removable prostheses after extraction of 11 and 21 (Fig.1A). This patient wanted fixed restoration in order to eat and chew well and expected high aesthetic result as well. In this case, patient lost her central maxillary incisives because of an accident. Patient had used a removable partial denture for six months after the extrations, and now the wound healing was completely done.

Figure 1A After extraction of tooth 11 and 21; **B** the X-ray panoramic

MANAGEMENT
The first stage when the patient came for a consultation was taking X-ray, that shows a defect due to tooth extraction, 11 and 21, which was done by adding bone graft in the area (Fig.1B). On the next visit, two implant placement Ø 3.3 x 10 mm (Straumann, Switzerland) was followed by bone grafting and membrane (Straumann, Switzerland) in areas of 11 and 21, then healing screw was placed to help guide the gingiva in the proper way to heal. Then, wound closure was performed by tension-free repositioning and suturing of the flap (Fig.2 and 3).

After 6 months, the healing screw was opened and a screw abutment was placed, which is the part that screws into the implant and will support the crowns (Fig.3). Once the abutment was placed, ano-

Figure 2A Two bone level implant fixture were inserted at region 11 and 21; **B** bone graft and membrane application; **C** wound closure by tension-free repositioning and suturing of the flap.

ther impression of the abutment for each replacement tooth were taken (Fig.4), then the patient got a temporary crown while the tissues continued to heal and form around the artificial tooth as with the natural teeth. Patient wore the temporary crown for four to six weeks. During this time, the permanent crown would be made. Then, the final stage was placing the crown. The crowns were cemented into the abutment of this patient (Fig.5).

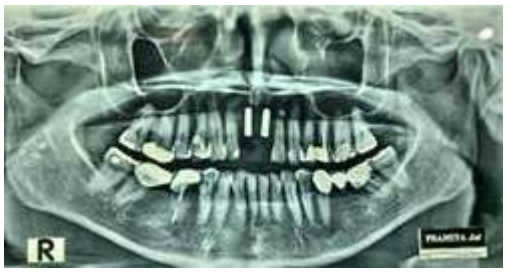

Figure 3 Panoramic foto six-months after implants placement

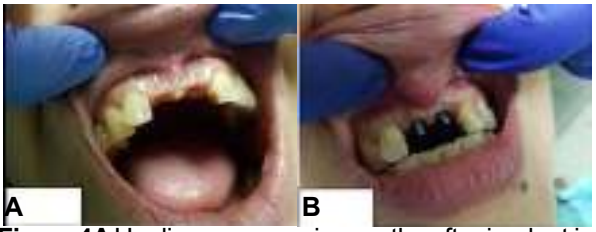

Figure 4A Healing process six-months after implant insertion; **B** two cemented abutments were engaged to the implants.

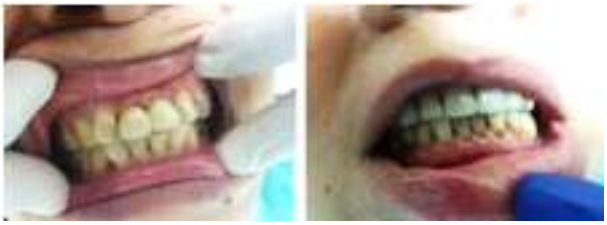

Figure 5 Two porcelain fused to metal crowns were chosen as final restorations

DISCUSSION

Teeth extraction is leaded by alveolar bone resorption which rapidly begins and continues for years. There are many different alveolar ridge preservation techniques after tooth extraction. The main goal of the bone graft material is to serve as a scaffold and maintain a space for bone ingrowth, blood vessels formation, to support soft tissues and to improve the quality and quantity of regenerated bone.[3]

In this case, there is resorption of the edentulous ridge post extraction which makes socket preservation. These procedures involve filling the socket with bone graft and membrane. The aim of socket preservation is new bone formation or osteogenesis.

Autogenous bone graft in exposed threads of the implant was suggested as a golden standard. After autogenous bone graft, xenogenic bone and absorbable membrane were used for additional augmentation for long-term esthetic results. At least 1.5-2 mm of buccal bone is required for esthetic results in the anterior maxilla.[4]

In this case, bone grafting was decided because of the presence of thin labial plate in areas 11 and 21. The indications for (GBR) are dehiscence or fenestration wound or thin labial plate which was expected to resorb during healing. If the width of the residual alveolar bone in the anterior maxilla was less than 3 mm, BBG was performed. BBG was performed in the anterior maxilla most frequently than in any other sites.[5] During GBR procedures, xenogenic bone with/without autogenous bone was the most commonly used. The advantages of the xenogenic bone include slow bone resorption during the healing phase and its wide availability. Although there was no bone dehiscence, xenogenic bone was recommended to graft for the augmentation of the labial bone. In this study, absorbable membrane (Straumann, Switzerland) was used for GBR procedure.[5] In this case, the porcelain fused to metal was cemented as final restorations.

It was concluded that implant can replace missing teeth in order to restore masticatory function and aesthetic for the patient. Bone graft was neces-

sary given as augmentation to the defect areas during implant surgery. The success of the treatment was depended on the treatment planning, cooperation with the patient and the skillfull operator. Oral hygiene and routinely check-ups are the responsibility of the patient.

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